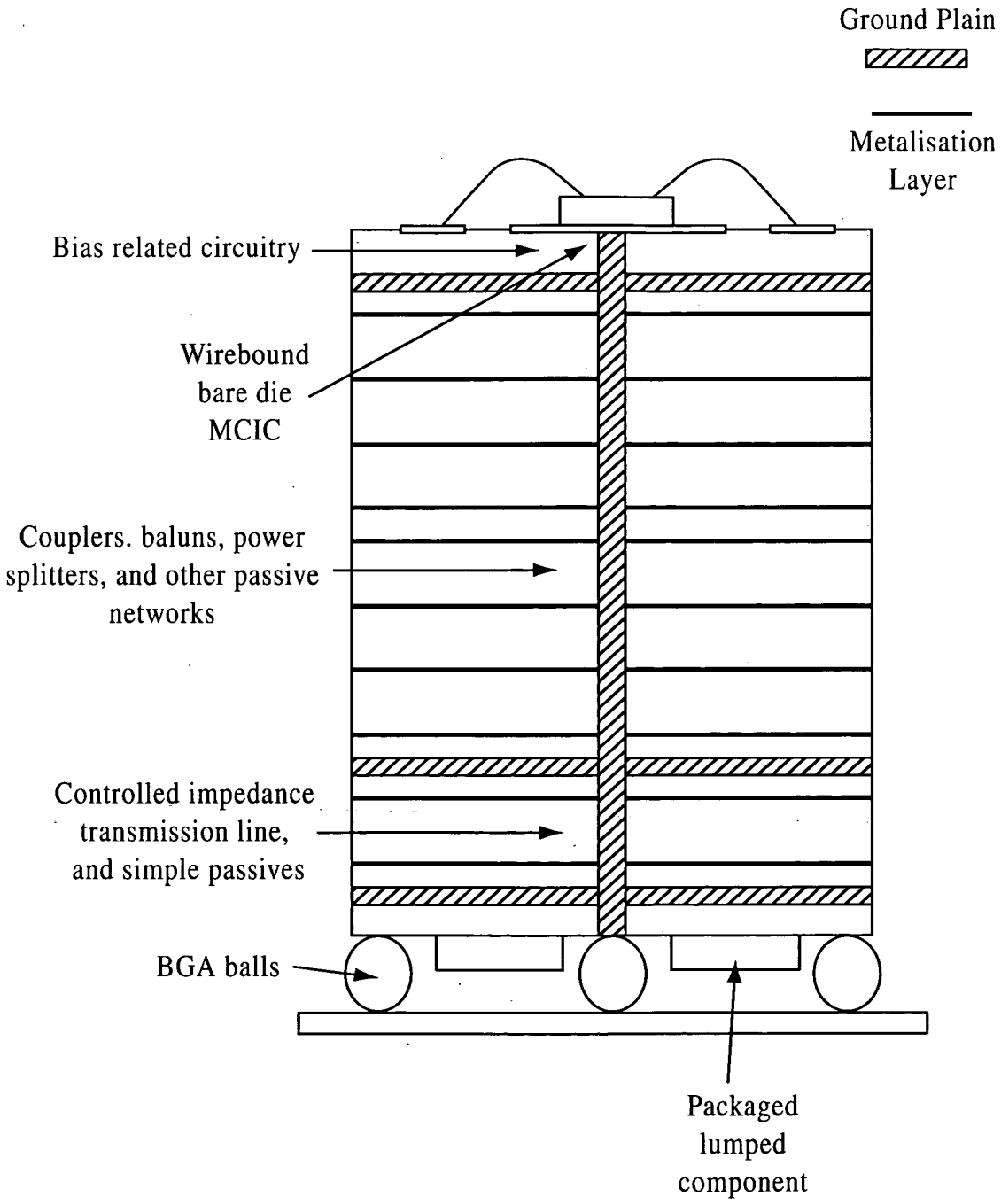


Fig. 1
PRIOR ART

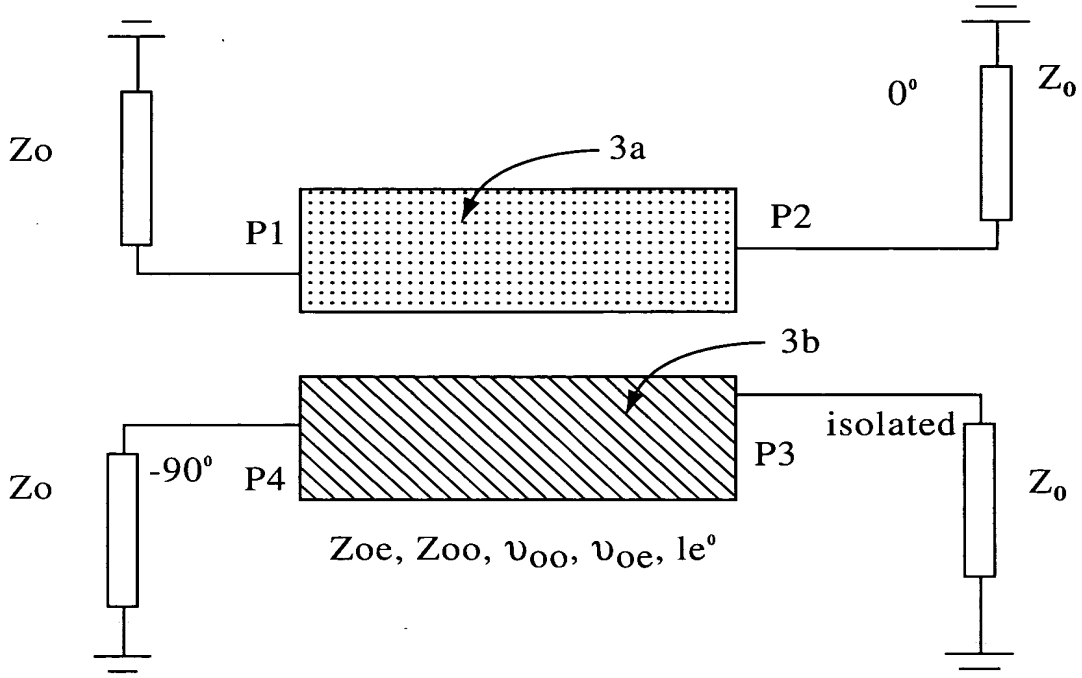
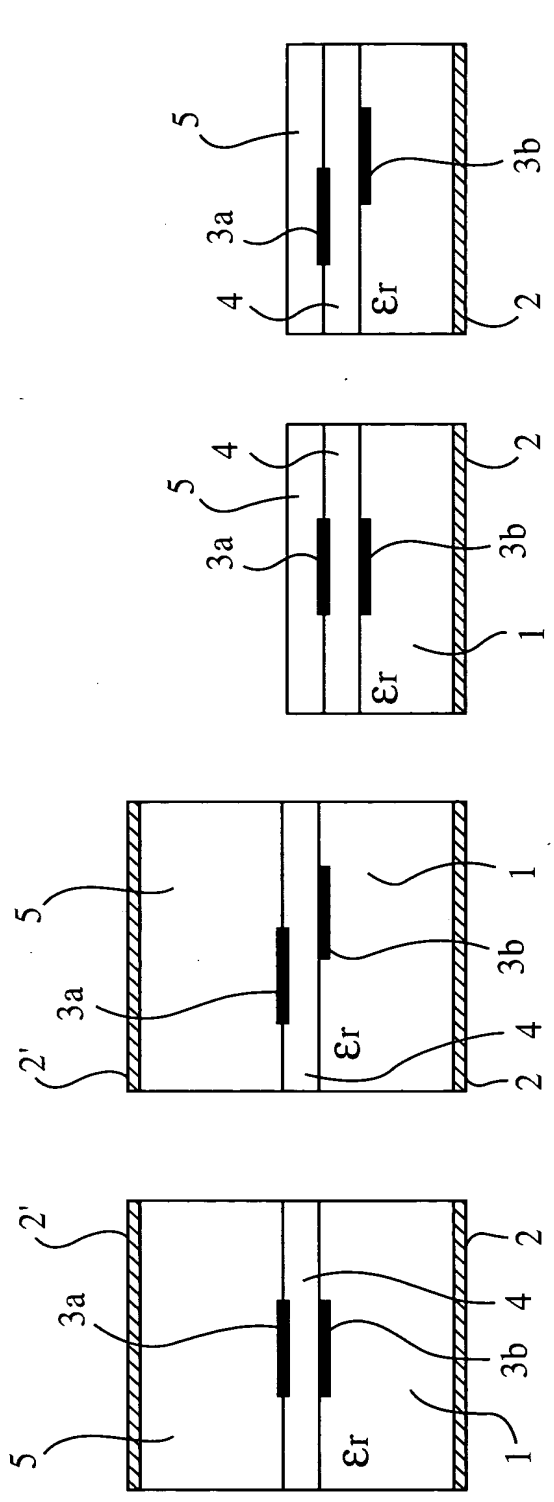


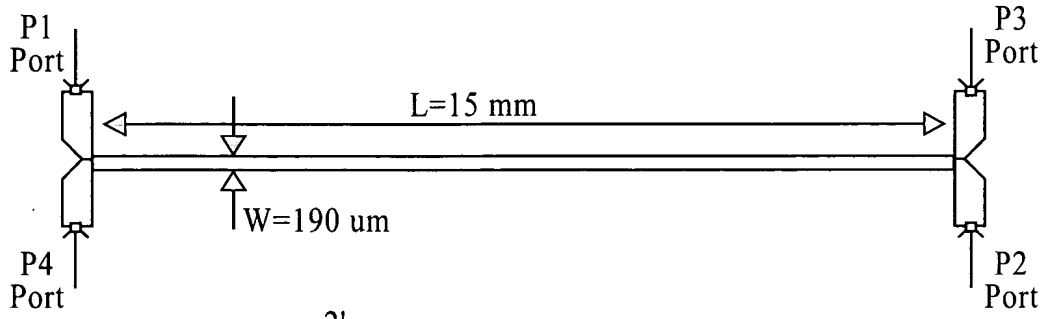
Fig.2
PRIOR ART

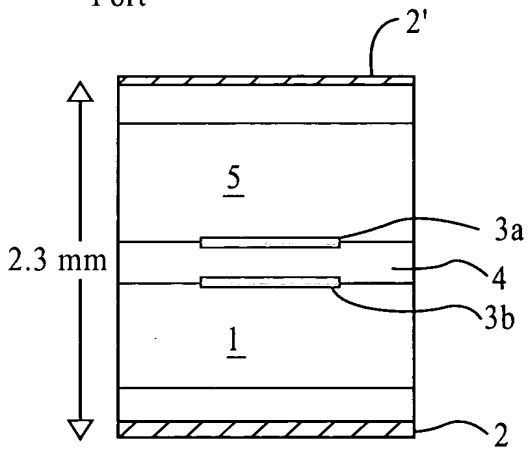


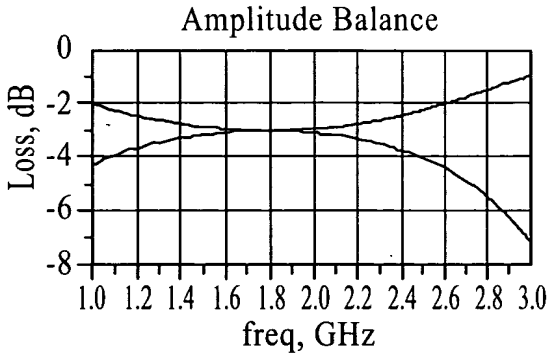
(a) Broadside Coupled Stripline (b) Offset-Broadside Coupled Stripline (c) Broadside Coupled Microstrip (d) Offset-Broadside Coupled Microstrip

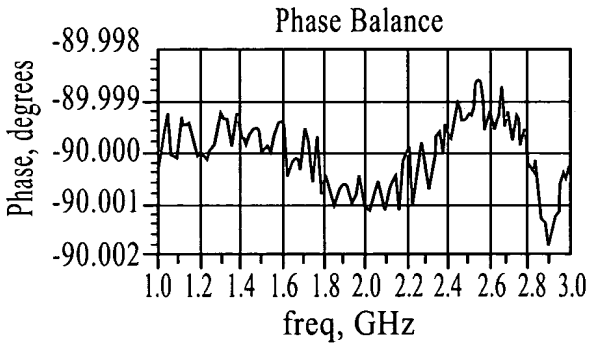
Cross-section of four broadside coupled structures.

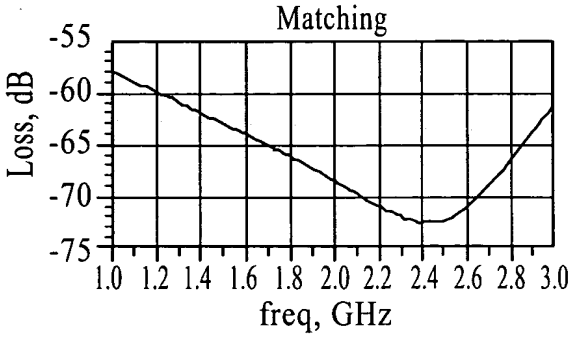
Fig.3
PRIOR ART











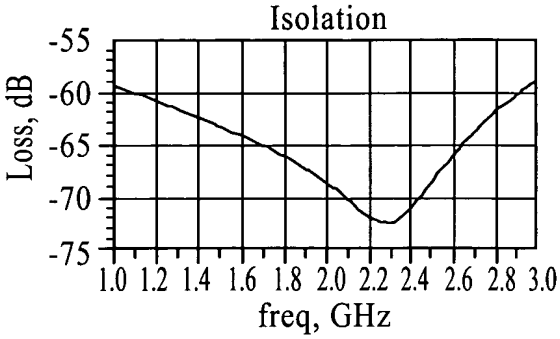
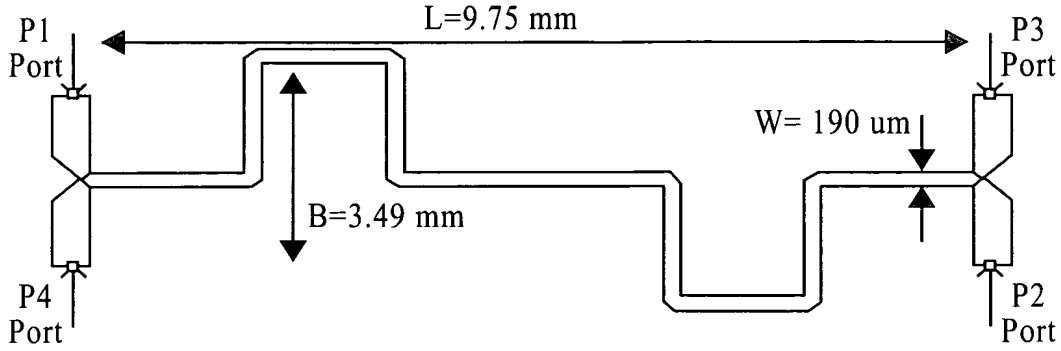
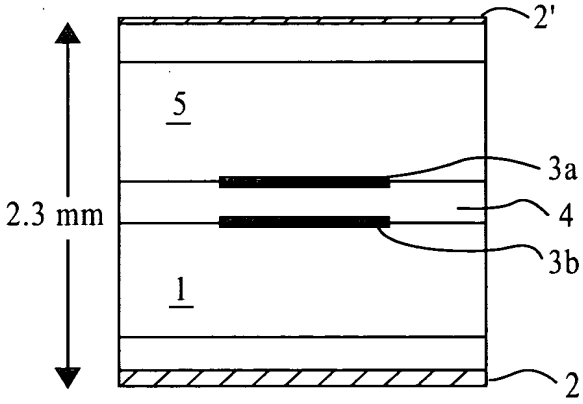


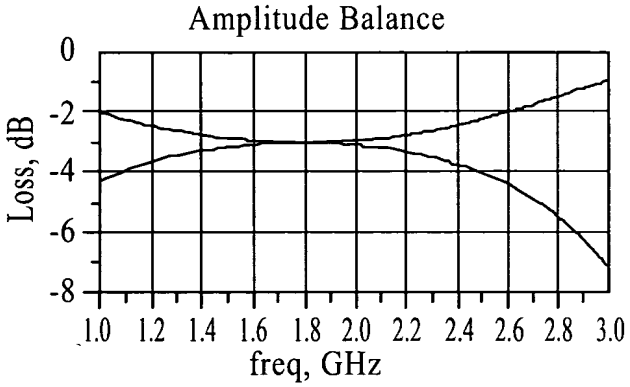
Figure 4. Conventional broadside coupled stripline coupler. Transmission line width W = 190 um; physical length L = 15 mm; substrate thickness 2.3 mm; structure designed in LTCC of Er = 7.8.

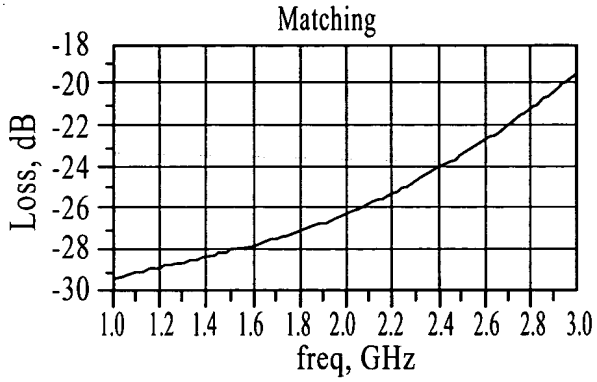
Fig.4

PRIOR ART









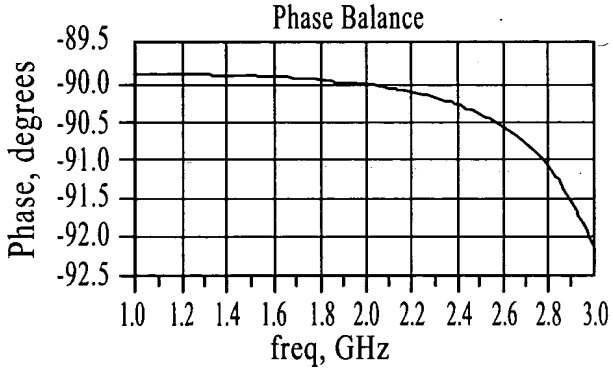


Figure 5. Meandered broadside coupled stripline coupler. Transmission line width W=190 um; physical length L= 9.75 mm; breadth B = 3.49 mm; substrate thickness 2.3 mm; structure designed in LTCC of Er = 7.8.

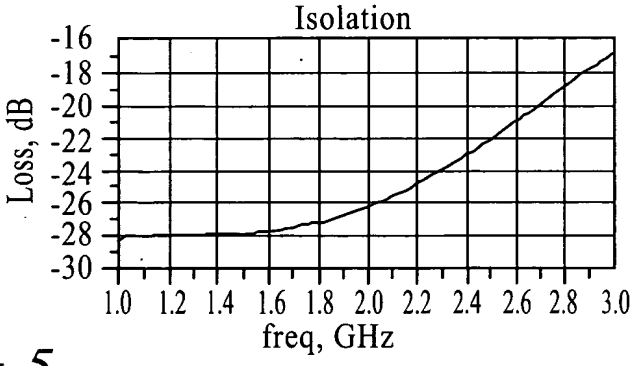
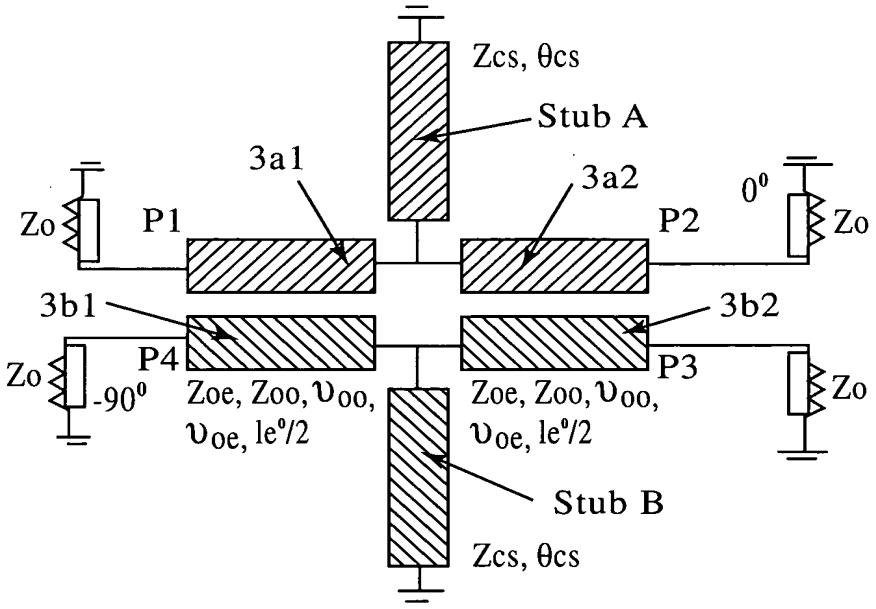
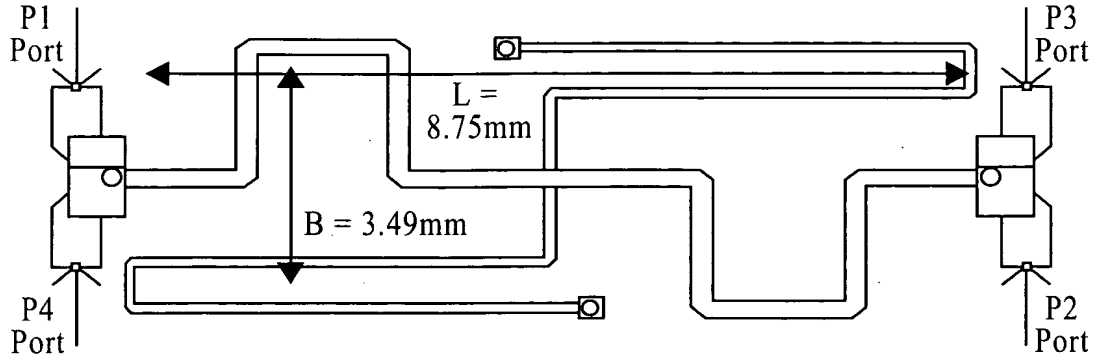


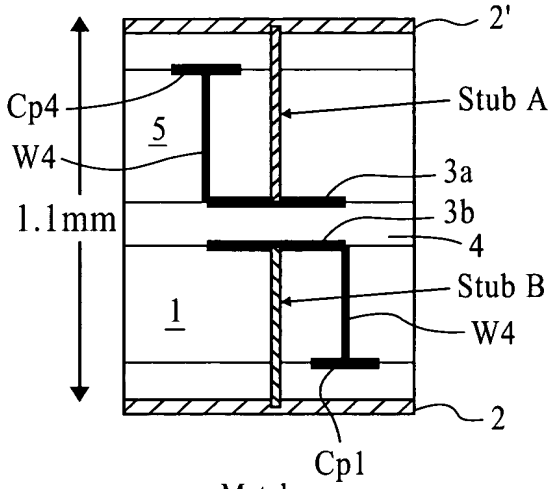
Fig.5

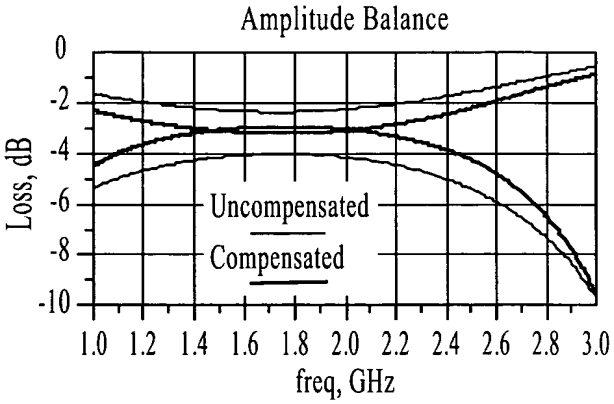
PRIOR ART

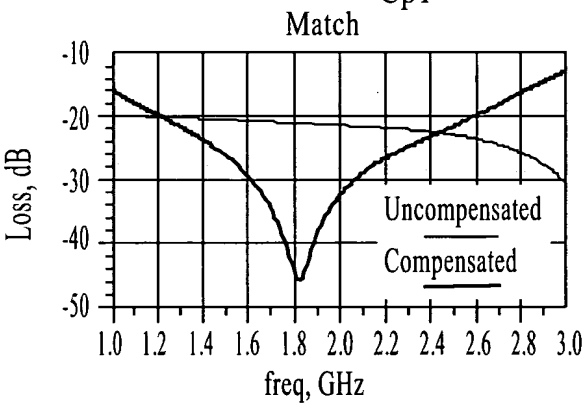
Fig.6

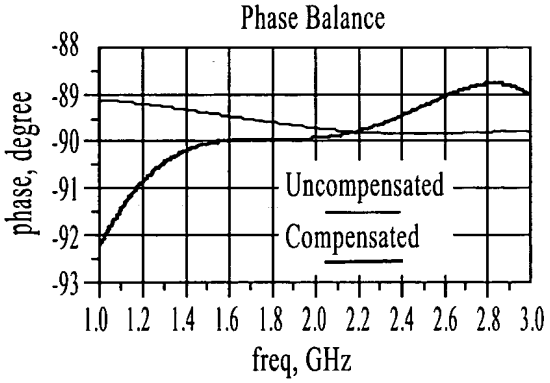

Zcs, θcs
Stub A
3a1
3a2
0⁰
Zo
P1
P2
Zo
3b1
3b2
Zo
P4
P3
-90⁰
Zoe, Zoo, υoo,
υoe, le⁰/2
Zoe, Zoo, υoo,
υoe, le⁰/2
Zo
Stub B
Zcs, θcs











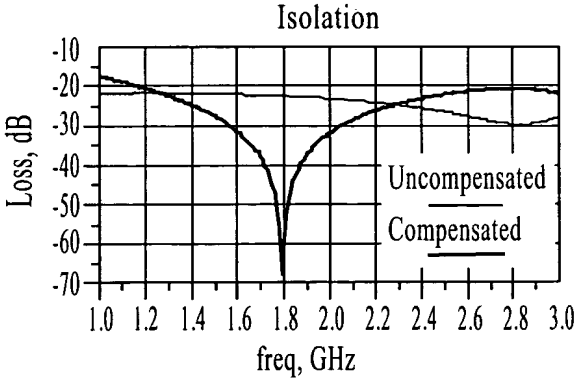


Figure 7. Compensated meandered broadside coupled stripline coupler. Transmission line width 210 um; physical length 8.75 mm; breadth 3.49 mm; substrate thickness 1.1 mm; structure designed in LTCC of Er = 7.8. Short-circuit stub total length 10 mm and width 125 um. Capacitors of 0.42pF

Fig.7

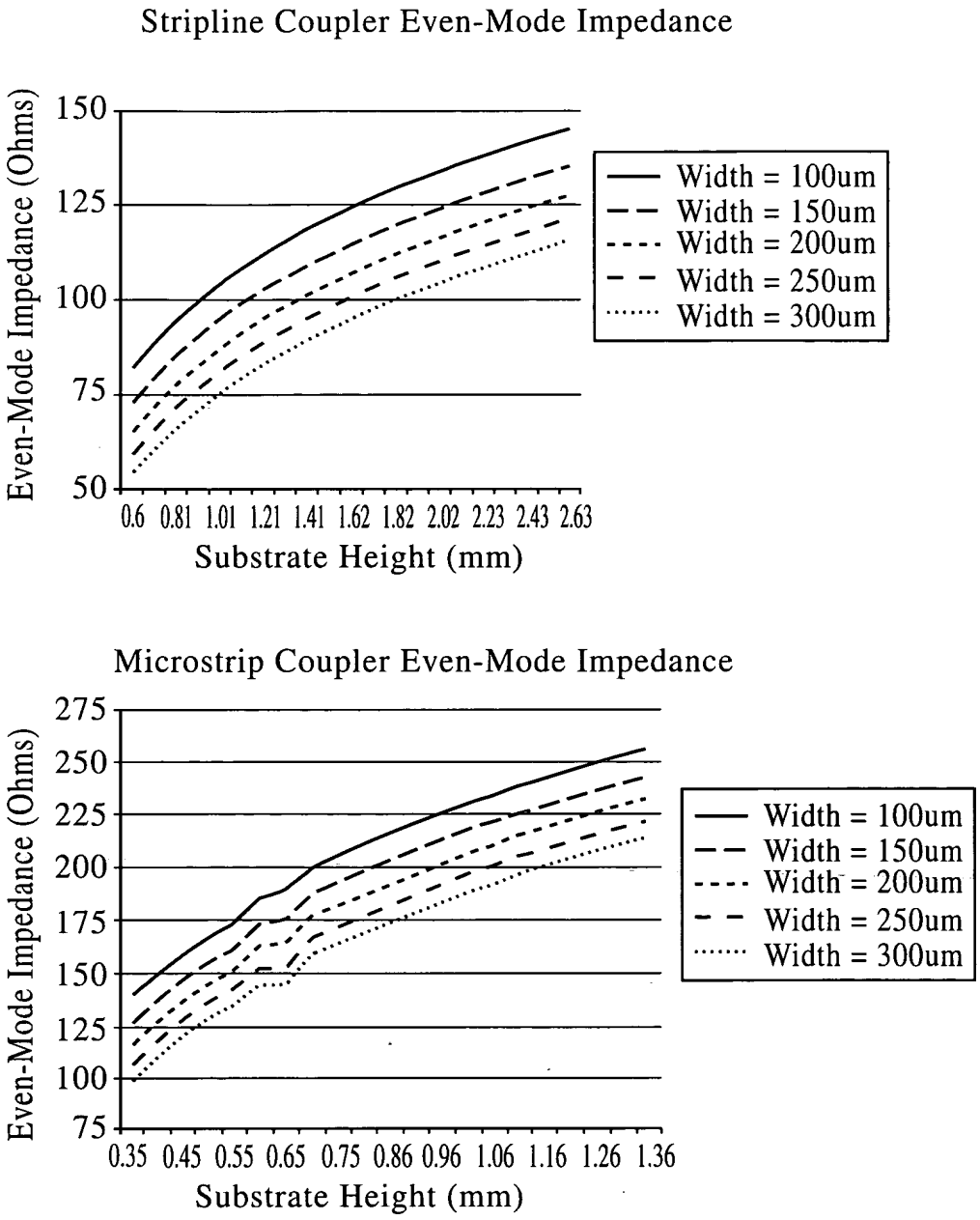
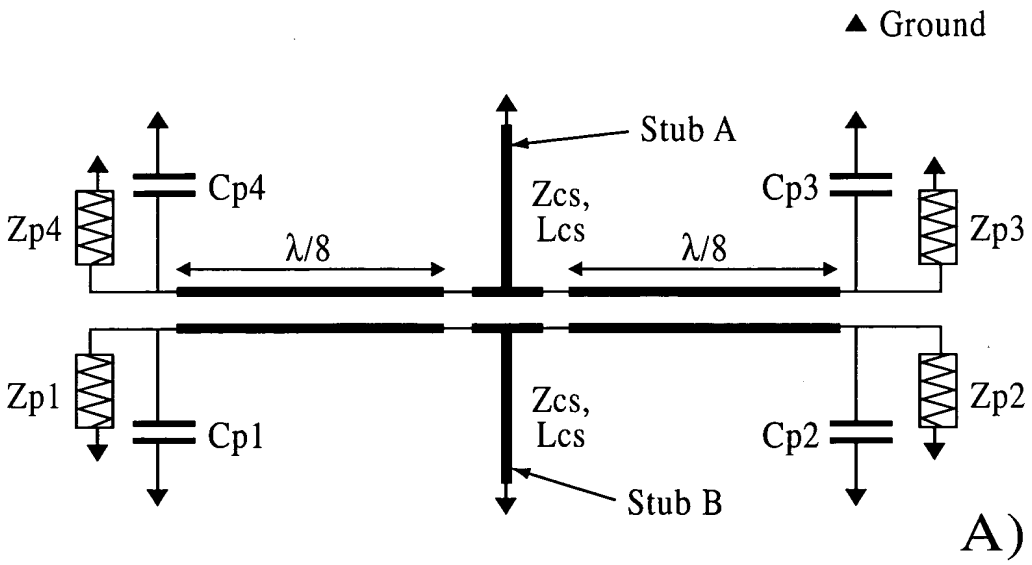
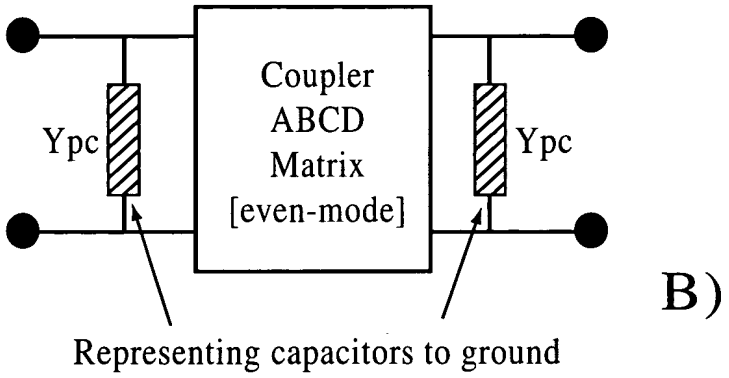

Stripline Coupler Even-Mode Impedance
Even-Mode Impedance (Ohms)
150
125
100
75
50
0.6 0.81 1.01 1.21 1.41 1.62 1.82 2.02 2.23 2.43 2.63
Substrate Height (mm)
Width = 100um
Width = 150um
Width = 200um
Width = 250um
Width = 300um
Microstrip Coupler Even-Mode Impedance
Even-Mode Impedance (Ohms)
275
250
225
200
175
150
125
100
75
0.35 0.45 0.55 0.65 0.75 0.86 0.96 1.06 1.16 1.26 1.36
Substrate Height (mm)
Width = 100um
Width = 150um
Width = 200um
Width = 250um
Width = 300um

Fig.8


▲ Ground
Stub A
Cp4
Zcs,
Lcs
Cp3
Zp4
λ/8
λ/8
Zp3
Zp1
Zcs,
Lcs
Zp2
Cp1
Cp2
Stub B
A)


Coupler
ABCD
Matrix
[even-mode]
Ypc
Ypc
B)
Representing capacitors to ground

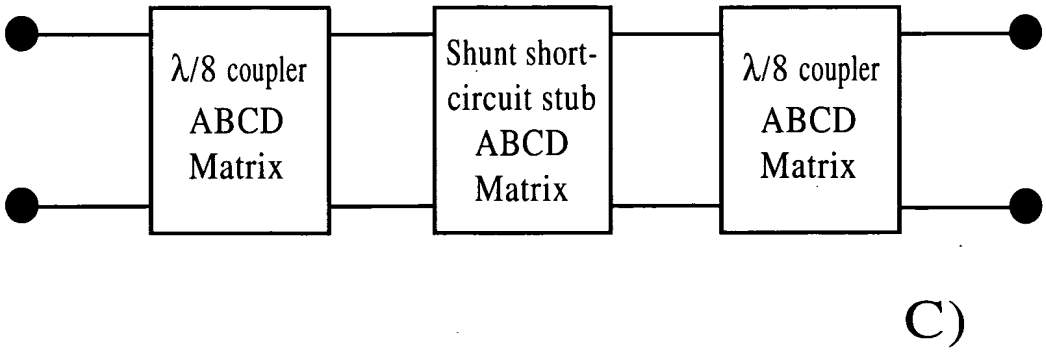

λ/8 coupler
ABCD
Matrix
Shunt short-
circuit stub
ABCD
Matrix
λ/8 coupler
ABCD
Matrix
C)

Fig.9

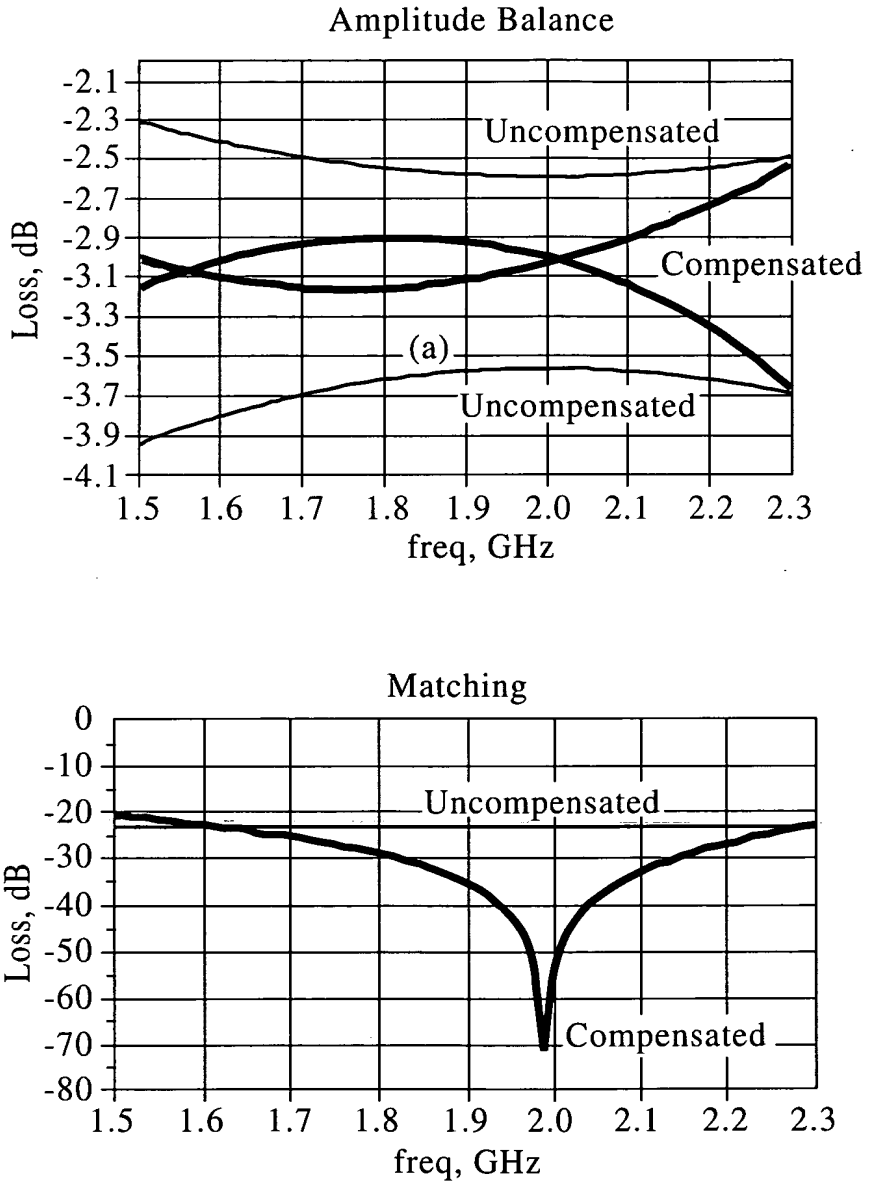

Amplitude Balance
Loss, dB
-2.1
-2.3
-2.5
-2.7
-2.9
-3.1
-3.3
-3.5
-3.7
-3.9
-4.1
Uncompensated
Compensated
(a)
Uncompensated
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
freq, GHz
Matching
Loss, dB
0
-10
-20
-30
-40
-50
-60
-70
-80
Uncompensated
Compensated
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
freq, GHz

Fig.10

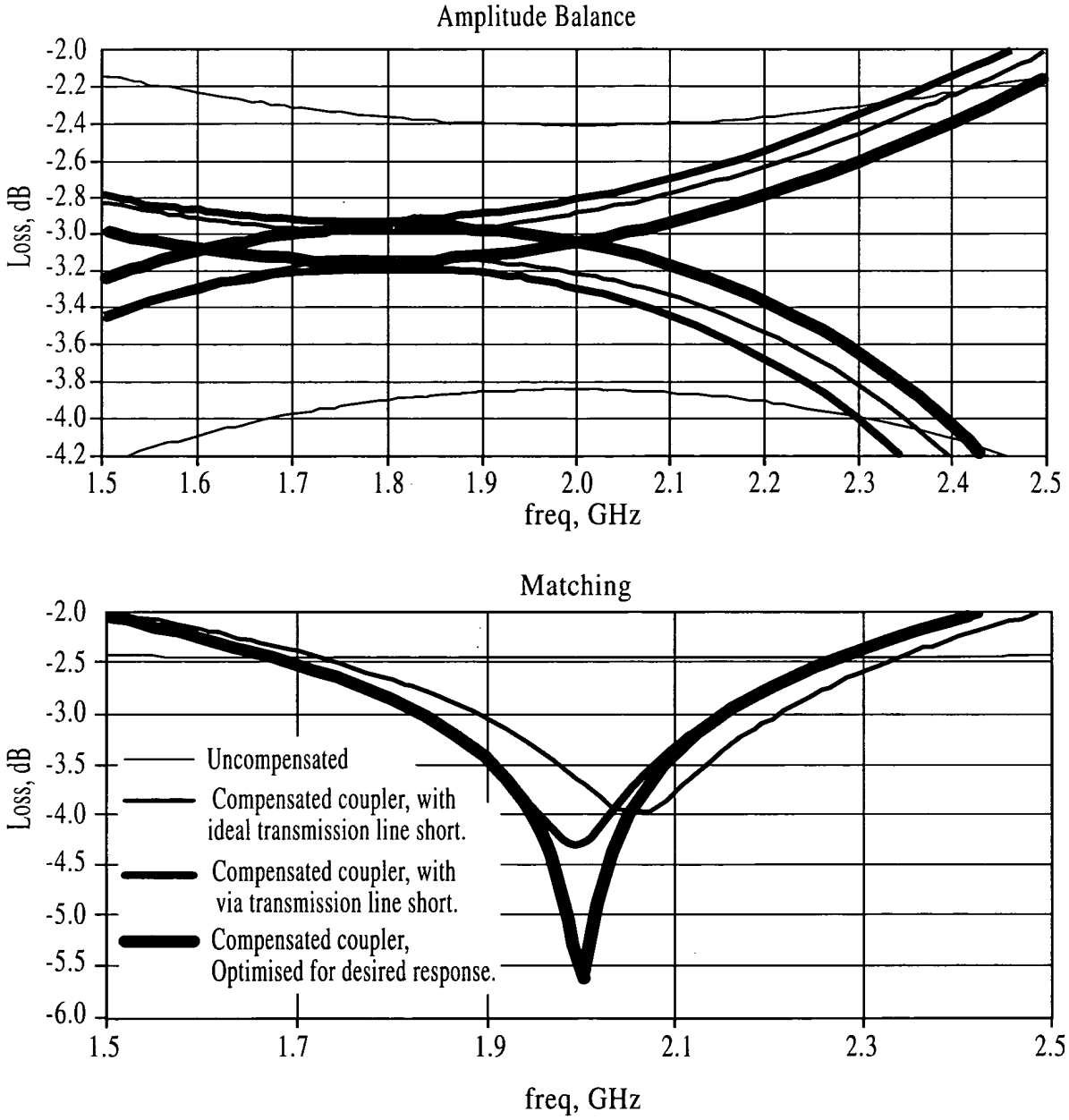

Amplitude Balance
Loss, dB
-2.0
-2.2
-2.4
-2.6
-2.8
-3.0
-3.2
-3.4
-3.6
-3.8
-4.0
-4.2
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
freq, GHz
Matching
Loss, dB
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
Uncompensated
Compensated coupler, with ideal transmission line short.
Compensated coupler, with via transmission line short.
Compensated coupler, Optimised for desired response.
1.5
1.7
1.9
2.1
2.3
2.5
freq, GHz

Fig.11

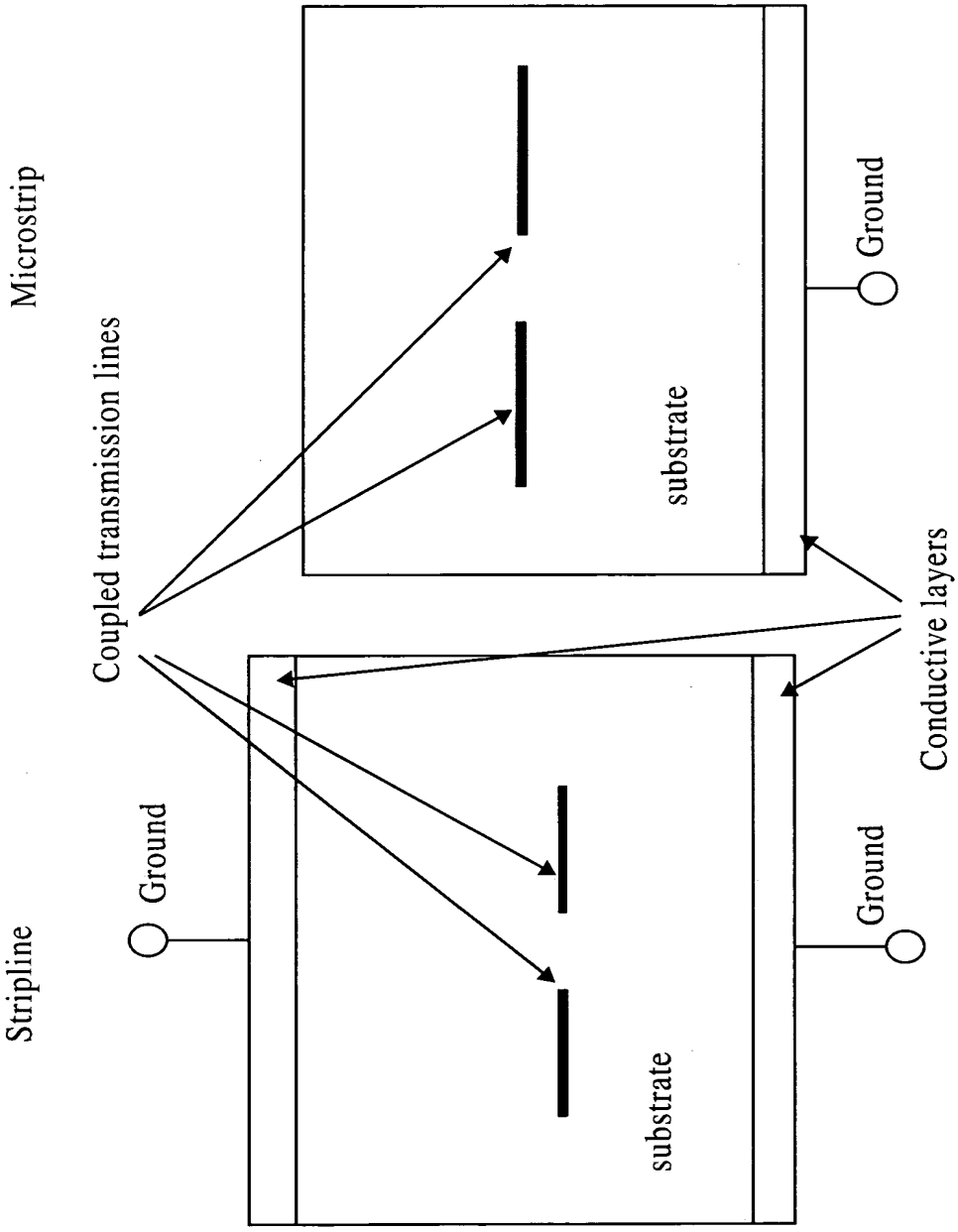


Fig.12
PRIOR ART